

HACK SAW

AND HOLE SAW
MANUAL

SIMONDS
SAW AND STEEL

DIVISION
WALLACE-MURRAY CORPORATION

HACK SAW AND HOLE SAW
MANUAL

* * * * *

* The purpose of this manual is to set forth the *
* necessary information so that more efficient use *
* of these products can be achieved with a resultant *
* increase in sales. *
* * * * *

SIMONDS SAW AND STEEL
Division Wallace-Murray Corporation
FITCHBURG, MASS.

Manufacture of Hacksaw Blades

Hacksaw Blades are divided into two major classifications: Hand and Power. Inasmuch as both types are manufactured in a similar manner, we will consider them jointly.

As the quality of a hacksaw blade depends to a large degree on the proper steel and its heat treatment, great care is given to these two phases of manufacture. At present our steel mill at Lockport, N. Y. is supplying 4 different steels from which our various types of hacksaws are made. Even though the quality of these steels cannot be excelled by outside producers, a careful check is made at Fitchburg by our Metallurgical Department to insure the maximum cutting ability of each finished blade.

When the laboratory has given its approval of the steel, it is sheared to length and width before toothing. The teeth are milled rather than punched to give greater accuracy and uniformity to the tooth form. Setting the teeth to provide clearance while cutting is the next operation. Power blade setting is done on a new setting machine developed by the company to give maximum clearance with a minimum of deformation of the tooth.

After the ends of the blades are rounded and the pinholes punched, the saws are ready for hardening. All blades that have only the tooth edge hardened are heat treated by a high temperature flame hardening.

All Hard blades are hardened in a salt bath. This method is not used generally in the hacksaw industry, but is far superior to the gas fired furnaces used by other manufacturers. (See Illus. 1)

It can be seen from this picture that it is necessary to have a large opening on the top of the furnace for placing blades into and removing them from the heating chamber. This opening plus the massive blade holders that must be used have a tendency to cool the top portion of this type furnace. More heat must be applied to overcome this situation. Consequently there is a large variation in temperature from the bottom to the top of the furnace. This condition is reflected in the finished blade by one end being under hardened and the other over hardened.

In heat treating hacksaws it is also very important to maintain the right atmosphere in the furnace. If this is not done, a soft surface may result which is particularly injurious to the blade. The large opening on this type of furnace makes it very difficult to maintain this uniform atmosphere.

Illustration 2 shows a salt bath furnace similar to the type used in the heat treatment of our hacksaws. Molten salt is heated electrically in this type furnace. A great amount of electrical energy keeps the molten salt circulating rapidly so that the temperature is uniform top, center and bottom. Also it will be noticed that a light holder can be used which has no chilling effect on the top of the bath. Since the blades are completely immersed in molten salt, there is no chance for improper atmosphere to create a soft

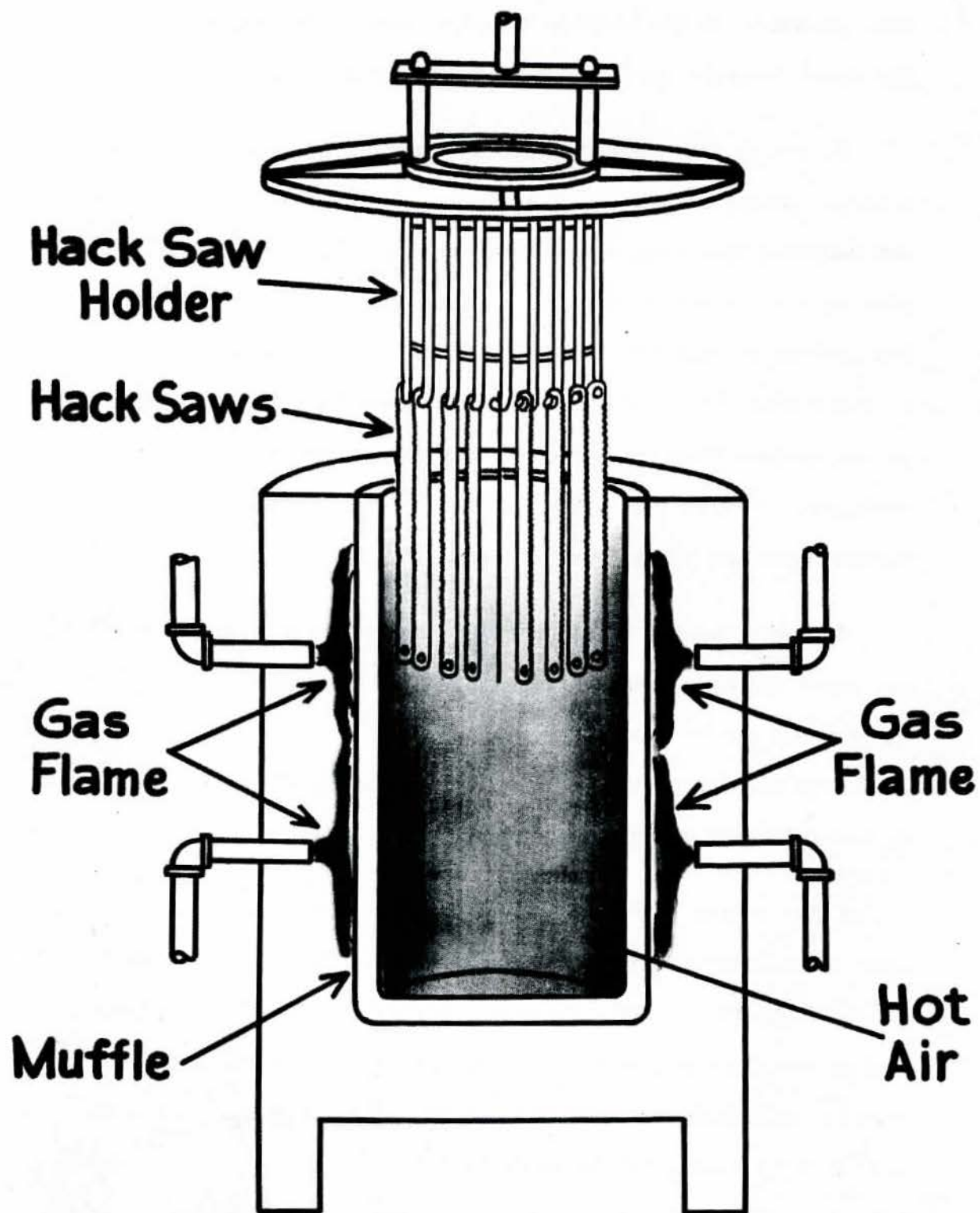


Illustration No. 1

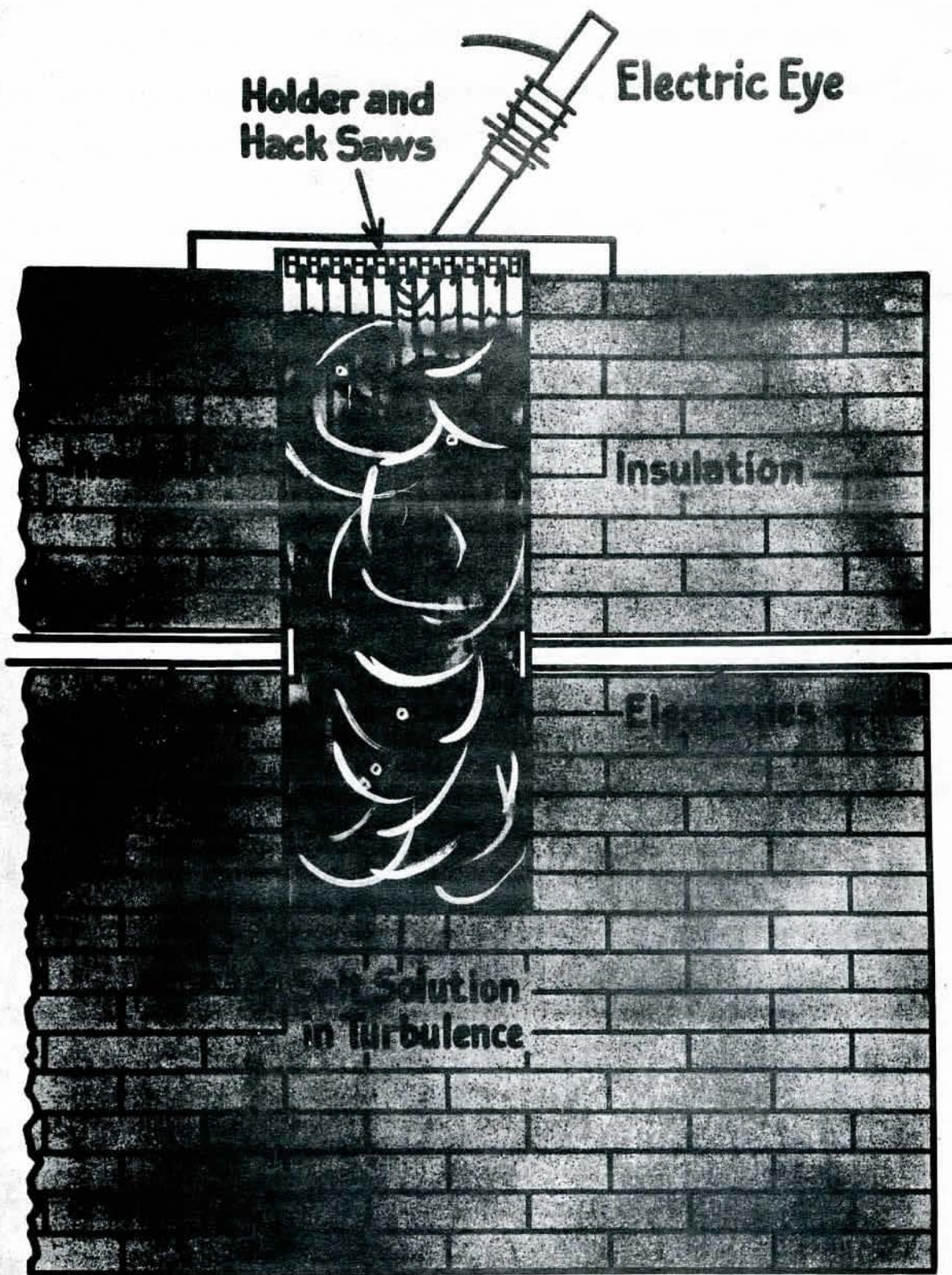


Illustration No. 2

surface on the blade. From the foregoing description it can be readily seen that our heat treatment is without parallel in the industry.

After hardening, all blades are put through a tempering operation to relieve the strains of hardening and thus make the blade more ductile. The pinholes must be then softened so that they will withstand the concentrated strain of tensioning. After careful inspection the blades are painted, boxed and ready for shipment.

HAND BLADES

Hand Hacksaw Blade performance depends to a large extent on the proper selection of the right saw and the skill of the individual operator. A study of Hand Blades in detail is therefore most important.

Hand Blades are made of three different types of steel:

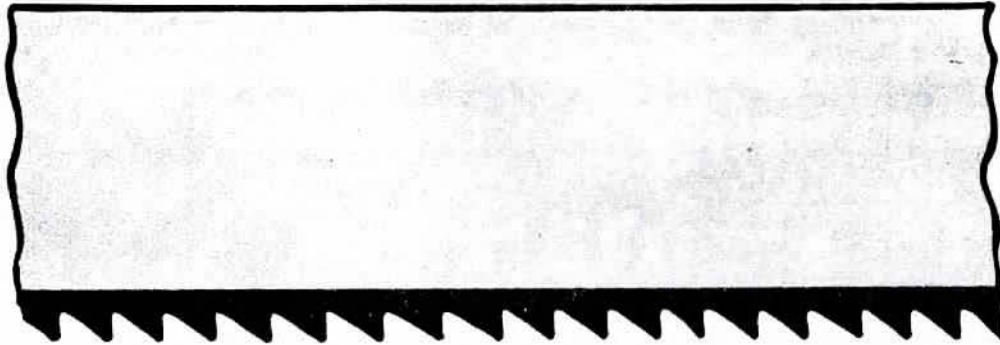
The Standard Blade (painted black) is made of an alloy steel. It is often referred to in the trade as the "Tungsten Blade" as the chief alloying element in competitive brands is Tungsten. Simonds Standard Blades, however, have Molybdenum as the important alloying element. This is a Simonds patented steel and extensive tests have proved this type of steel to be superior in cutting qualities and toughness. Standard blades do not have the long wearing qualities of our Molybdenum or Tungsten High Speed Blades under excessive heat. In other words, at a temperature of around 350° F. the teeth have a tendency to dull very quickly. In hand sawing, especially on high alloy steel, it is very easy to create this temperature on the tips

of the teeth. Therefore it cannot be stressed too strongly that this blade should not be operated at over 50 strokes per minute. Due to its low cost this blade is sold extensively in the hardware trade.

The Standard Blade is made with two different types of hardening: Hard Edge. The term Hard Edge signifies that only the tooth edge is hardened. (See Illus. 3) This leaves the back of the saw softer than the tooth edge, allowing it to absorb the strain of cutting without breaking. Hard Edge Blades are often called in the trade "Flexible" or "Unbreakable". These blades are recommended where unskilled operators are to use the blade.

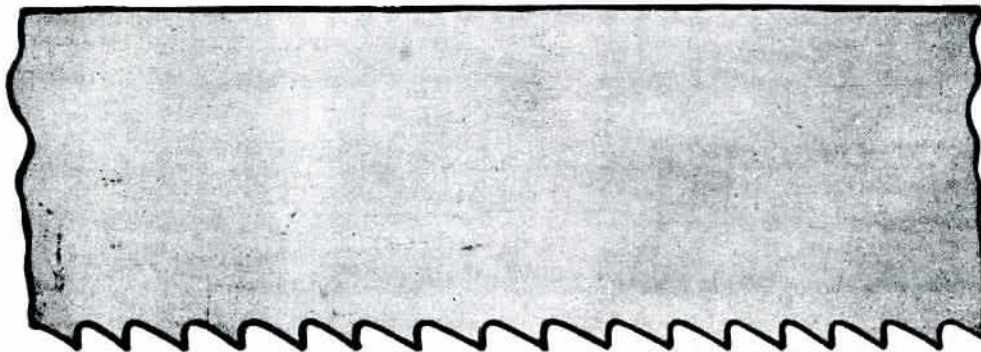
All Hard. All Hard Blades are hardened throughout their entire width. This makes them more susceptible to breakage but gives the blade more rigidity and stiffness, a characteristic that many experienced operators consider desirable. Today, Standard All Hard Blades are sold in limited quantities as most skilled operators prefer one of the High Speed type blades. (See Illus. 4)

Molybdenum High Speed Hand Blades (painted Red) are made of Molybdenum High Speed Steel. This is a high alloy steel with the characteristic of all high speed steels, that of holding a cutting edge even at very high temperatures. Actually, to create the softening effect mentioned under Standard Blades, temperatures of over 1000° must be reached. It is virtually impossible to generate such high temperatures while hand cutting. A general misconception in the field is that only High Alloy Tungsten Steels can be classified as High Speed Steels. This is not the case, for Molybdenum Steels are also classified as High Speed. Molybdenum Blades are exceedingly tough and will



Hard Edge

Illustration No. 3



All Hard

Illustration No. 4

hold their cutting edge under severe conditions. With High Speed Molybdenum Steel Blades, it is not as important to control the number of strokes per minute.

Molybdenum Blades are also made Hard Edge and All Hard. Hard Edge blades are used mostly when cutting conditions are not ideal. Maintenance men who are generally cutting without the aid of a vise, usually use the Hard Edge type blade.

All Hard Blades are most popular with experienced mechanics. The extra rigidity of this blade makes very accurate cutting possible.

Tungsten High Speed Hand Blades (painted Grey) are similar in cutting characteristics and durability to Molybdenum High Speed Blades. While some manufacturers do not even make this type of blade, we find this saw has a definite field. Although the Tungsten High Speed Blade is not as tough as the Molybdenum Blade, it will outperform it in cutting high alloy steels such as stainless steel.

As in the case of Standard and Molybdenum Blades, Tungsten High Speed Blades are made in Hard Edge and All Hard types. Like Molybdenum Blades, Tungsten Hard Edge blades should be used under adverse conditions and All Hard blades by the skilled mechanic.

Tooth Spacing and Set

"Easy-Kut" Hand Blades

A problem often encountered in using hand blades is the difficulty in starting the cut accurately and without damaging the teeth. This difficulty is most pronounced when cuts must be started on sharp corners and when unskilled operators are involved. A new patented tooth design

called "Easy-Kut" has rectified this situation. Today all Simonds Hard Edge blades, regardless of steel analysis, are manufactured with this tooth design.

Conventional hack saws have identical teeth throughout their whole length. The front, or cutting edge, of these teeth are perpendicular to the back edge of the blade. This causes them to grab hold of the stock, making it difficult for the operator to start the cut. "Easy-Kut" blades have differently shaped teeth on the leading end (Red End) of the blade. These teeth, instead of being perpendicular on their cutting edge are tipped backwards making it almost impossible for the saw to grab at the start of the cutting stroke. (See Illus. 4-A.)

All All-Hard blades are still furnished with the conventional teeth for their full length.

All Hand Blades are furnished in four different tooth spacings - 14, 18, 24 and 32 teeth per inch. (See Illus. 5) This wide variety of tooth size makes it possible to cut most any size or type of material that is in practical use today. Blades with 14 and 18 teeth are furnished with regular set, sometimes called raker set. That is, one tooth set or pushed to the left, the next to the right and the third tooth unset. This sequence is repeated throughout the length of the blade. (See Illus. 6a) Blades with 24 and 32 teeth are furnished with wavy set. Clearance is provided on this style of blade by alternately pushing groups of teeth to the right and left. (See Illus. 6b)

Choice of Proper Tooth

Proper tooth selection on any hand blade is dependent on two factors: the type of material to be cut and its size. If the cross

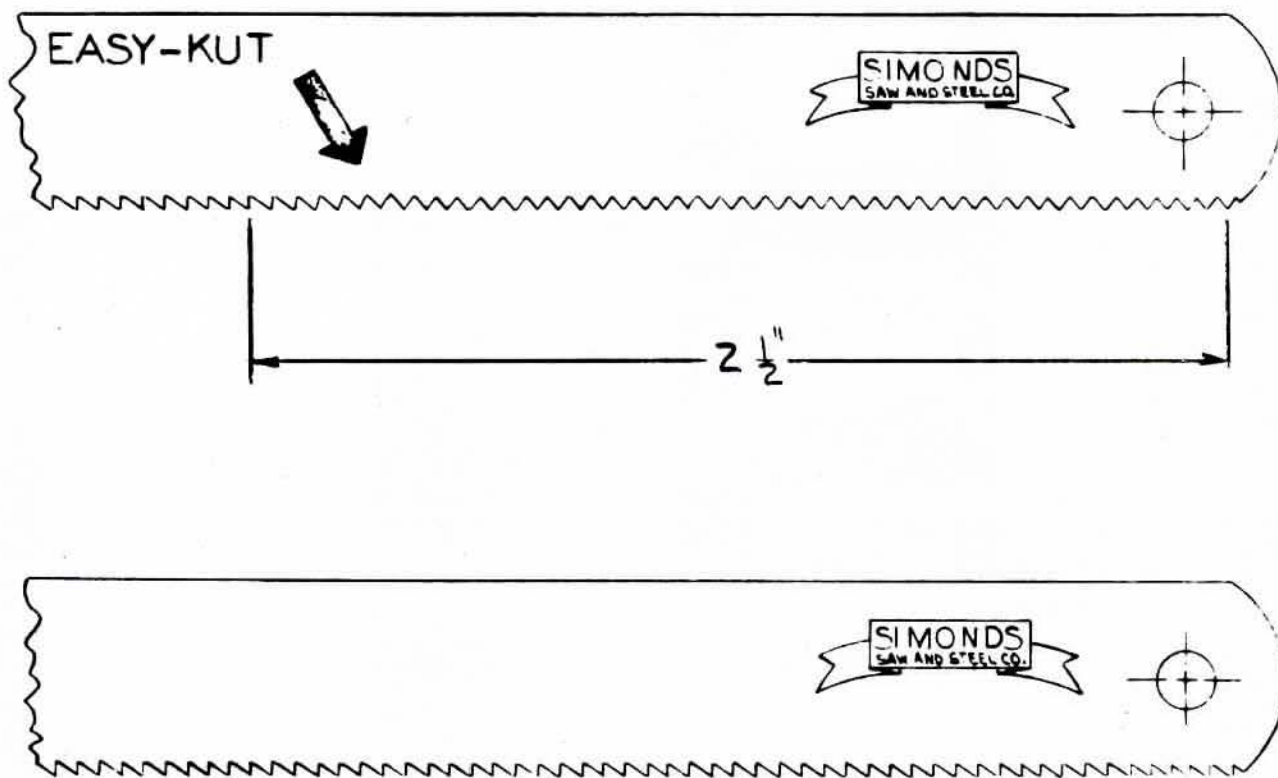


Illustration No. 4 a

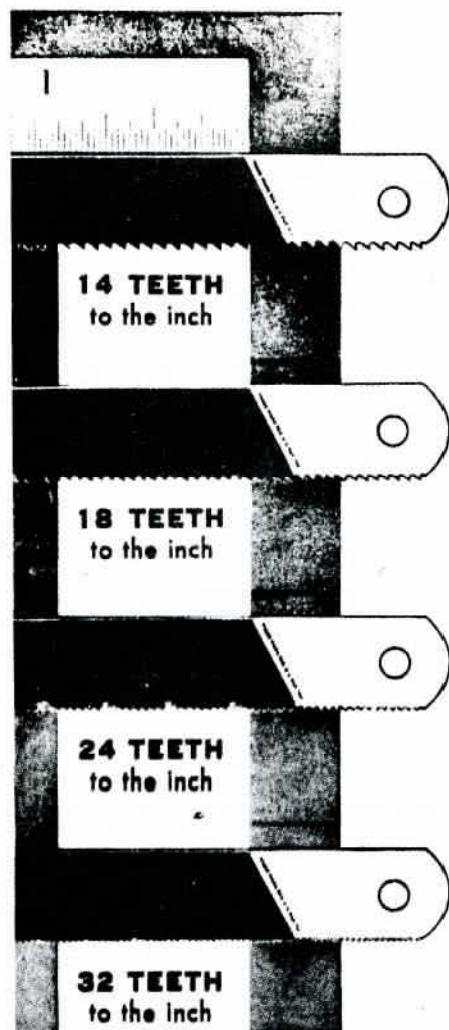
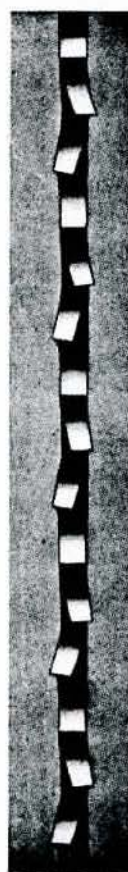


Illustration No. 5



REGULAR SET



WAVY SET

Illustration No. 6 a Illustration No. 6 b

section is small, the thickness of the piece to be cut determines tooth spacing, as it is always necessary to have three teeth in contact with the work. Therefore, on thin stock, tooth selection is governed by stock thickness.

32	tooth	blades	should	be	used	on	stock	from	.055"	to	.085"	thick
24	"	"	"	"	"	"	"	"	.085"	to	.105"	thick
18	"	"	"	"	"	"	"	"	.105"	to	.150"	thick
14	"	"	"	"	"	"	"	"	.150"	and	thicker	

If less than three teeth are in contact with the work, the load on each tooth becomes excessive, causing teeth to break. (See Illus. 7a)

As the size of the stock increases to the point where the 3 tooth rule no longer is applicable, the hardness of the material determines tooth selection. In cutting soft materials, larger chips are formed. To make room for these larger chips, it is necessary to have more chip room in the gullets of the saw to prevent clogging. Therefore, on soft materials the use of a coarse tooth saw is indicated. As hardness of stock increases, less gullet room and more cutting teeth are needed, so a finer tooth saw should be used.

32 tooth blades should be used on hard materials such as heat treated stock, drill rod, etc.

24 tooth blades should be used on medium hard stock such as tool steels.

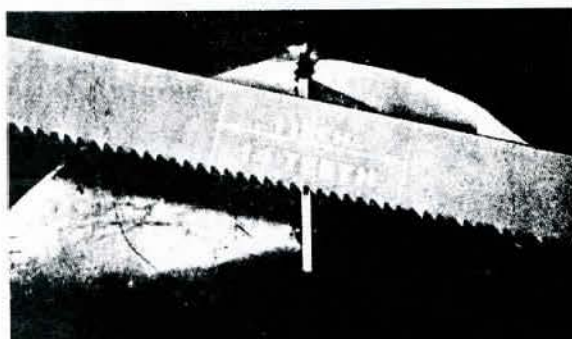
18 tooth blades are used for mild steels, hard brasses, etc.

14 tooth blades are best suited for cutting soft steels, brass, aluminum and copper. (See Illus. 7b)

Often compromises must be made, and a variety of work cut with one saw. In most of these instances an 18 tooth or a 24 tooth blade will



Correct blade—Three teeth will be in cut



Blade too coarse—Teeth will catch on work

Illustration No. 7 a

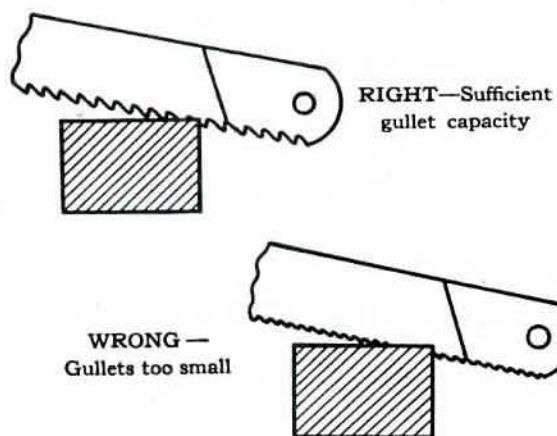


Illustration No. 7 b

satisfy the requirements. For this reason they are the most popular size tooth spacing.

The Operation of Hand Hacksaw Blades

The Frame

Hand hacksaw frames should be inspected from time to time to see that they are giving the blade proper support. It is often found that adjustable frames become worn and have a tendency to twist when the blade is inserted and tightened. The frame should also be rigid enough to allow proper tensioning of the blade. Pins stand all the strain of tensioning hand blades and often become badly worn. (See Illus. 8) Such pins should be replaced or a new frame obtained as worn pins put severe strain on the pinholes of the blade and may cause breakage.

Be sure the blade is placed in the frame with the teeth pointing away from the handle. It is also important to have the pinholes of the blade firmly seated at the base of the pin, for if this is not done, the blade will not be aligned properly. Be sure to tension the blade sufficiently so that it will not buckle in the cut. Hard Edge Blades should be tensioned slightly more than All Hard. After the first few strokes the blade should be retightened.

Operation of Hand Blades

Cutting with a hand hacksaw can be made easy if a few rules are followed.

Work to be cut should be firmly held, if possible, and cutting should be done close to the jaws of the vise. If vibration of the

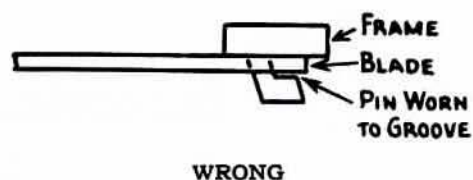
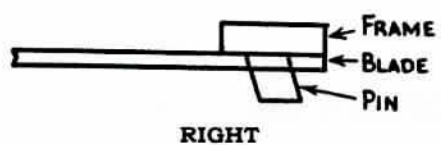


Illustration No. 8

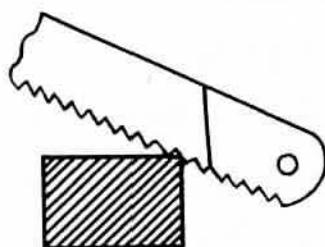


Illustration No. 9

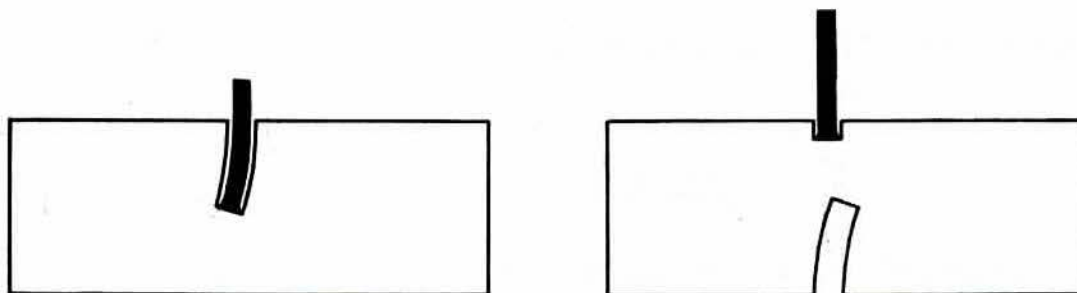


Illustration No. 10

stock occurs while sawing, unnecessary strain is put on the teeth of the blade. The first few strokes taken with a new blade should be made carefully and with little feeding pressure, to protect the keen edges of the teeth.

Use the full length of the blade in cutting, employing your forward hand to pull the saw through the cut as well as guiding the saw frame. This will help overcome the rocking motion used by so many operators which is extremely hard on the blade. Always relieve all feeding pressure on the return stroke. Hacksaws are made to cut only on the forward stroke and they will dull rapidly if allowed to drag on the back stroke.

After the first few strokes the down feed on the forward stroke can be increased. Always feed hard enough so that you can feel the teeth cutting, as teeth that slide over the work and do not cut wear out very rapidly. Never start your cut on sharp corners, otherwise you will violate the "three tooth rule" no matter what blade you use. (See Illus. 9)

If the saw does not run smoothly in the cut after following the above simple rules, the wrong blade is being used. If the blade sticks in the cut, remove the saw and examine the teeth. If chips are sticking in the gullets you are using too fine a tooth blade on soft material. Try a coarser tooth saw. If the blade jams and cuts noisily, it is quite possible you are using too coarse a tooth blade on thin stock.

If the work is so thin that even a 32 tooth blade won't cut it smoothly, place two pieces of wood on either side of the stock to be cut. This will prevent the teeth from straddling the work and will

minimize tooth breakage.

If the saw starts to cut crooked, do not attempt to straighten the cut by twisting the saw frame. This may result in a broken blade. Turn the piece over and start cutting from the other side. (See Illus. 10) It is also well to remember that a new blade should not be used in an old cut. Again, turn the stock over and cut from the other side.

Using Light Power Blades in Hand Frames

It will be noticed in reading the specifications of regularly furnished hacksaws that all Hand Blades are one half inch wide by .025" thick. Blades of these dimensions will cut satisfactorily on practically all jobs. However, occasions sometimes arise where the use of a heavier blade is advisable, especially where large sections must be cut accurately. Under these conditions a light Power Blade five eighths of an inch wide by .032" thick will work to good advantage. There are several frames on the market made expressly for this larger saw, and are known in the trade as rail saw frames.

Power Machines Using Hand Blades

There are several power operated hacksaw machines on the market which use Hand Blades in their frames. It should be remembered that these machines impose very severe conditions on a Hand Blade. Great care should be used in selecting the right blade for the stock to be cut. Attention also should be given to see that the feed of these machines is not excessive and that the frame lifts on the return stroke. The light Power Blade mentioned above often works to good advantage on this type of machine.

POWER HACKSAW BLADES

Types of Power Blades

To fill all the needs of Power Blade sawing, Simonds makes three different type saws: Molybdenum High Speed, Tungsten High Speed and Weld-Edge.

Molybdenum High Speed (painted Red) - Molybdenum High Speed steels were developed in the 1930's as an alternative to the Tungsten type. With improvement in rolling practices and heat treating operations, this steel has to a great extent replaced the more expensive Tungsten type in the cutting tool industry. Molybdenum Blades in 90% of the cutting applications will do fully as much work as the Tungsten Blade. They also have the additional quality of greater toughness over Tungsten types.

Tungsten High Speed (painted Gray) - Where high alloy or hard steels are to be cut, Tungsten High Speed Blades will often cut more stock than the Molybdenum types. Tungsten Blades have more resistance to the abrasive characteristics found in high nickel and chrome alloy steels. These blades are not as tough as the Molybdenum Blades and care should be taken to see that machine conditions are satisfactory before installing them. Due to their higher price, several blade manufacturers do not actively stress the sale of these blades.

Weld-Edge (Sand Blast Finish) - The Weld-Edge Blade was developed to fill a definite need for an unbreakable blade. Safety engineers are often interested in a blade that will not shatter with possible injury to the operator. All hard blades are most apt to break when cutting multiple stock where it is difficult to hold all pieces firmly.

Old machines also can cause ordinary blades to break.

Simonds Weld-Edge Blades have a cutting edge of High Speed Steel of a different analysis than the regular All Hard types. This is a high vanadium content steel which is outstanding for its toughness and wear resistance. The edge is electrically welded to a tough chrome vanadium backing. The backing is designed to give a maximum of rigidity. In fact, Simonds Weld-Edge Blades approximate the desirable quality of stiffness found in All Hard blades but still retain their unbreakable features. This is especially noticeable when comparing Weld-Edge with competitive brands of so-called unbreakable blades, which all lack the necessary rigidity to make for best cutting.

Although other types of so-called unbreakable blades may still be found in the field, most manufacturers are now using a construction similar to ours. The blade blanks are welded by a steel mill and the blade manufacturer does not have the control over the product that we have. Ours are welded in our own plant. The other types of unbreakable blade are shown in Illustration 11. One type has two welds, the other is solid high speed steel with just the edge hardened. Both types have proven to be inferior to the single weld type.

Choice of Correct Tooth Spacing

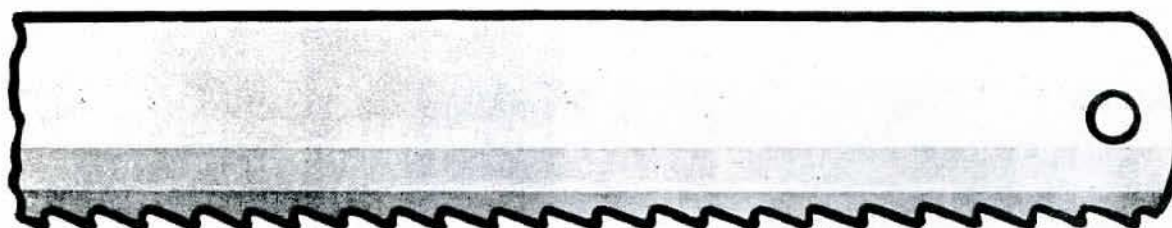
Power Blades are made in six tooth spacings: 2-1/2, 3, 4, 6, 10 and 14 teeth per inch. (See Illus. 12)

Two and one half tooth blades. This tooth space is standard only on 36" Power Blades. These blades are used only on the larger machines which cut stock up to 24" square. Since each tooth must remove such



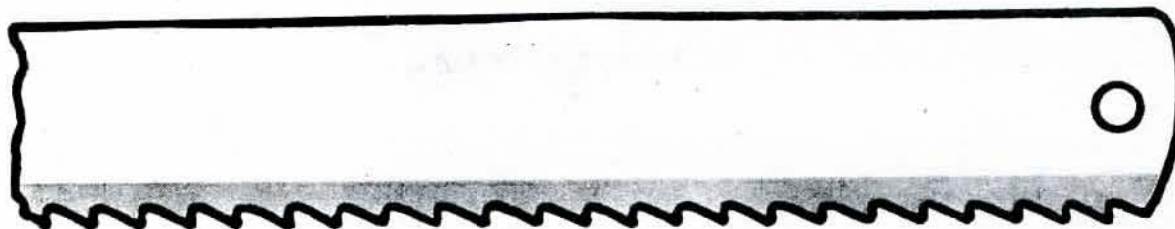
"WELD EDGE" (Shatterproof)

SINGLE WELD

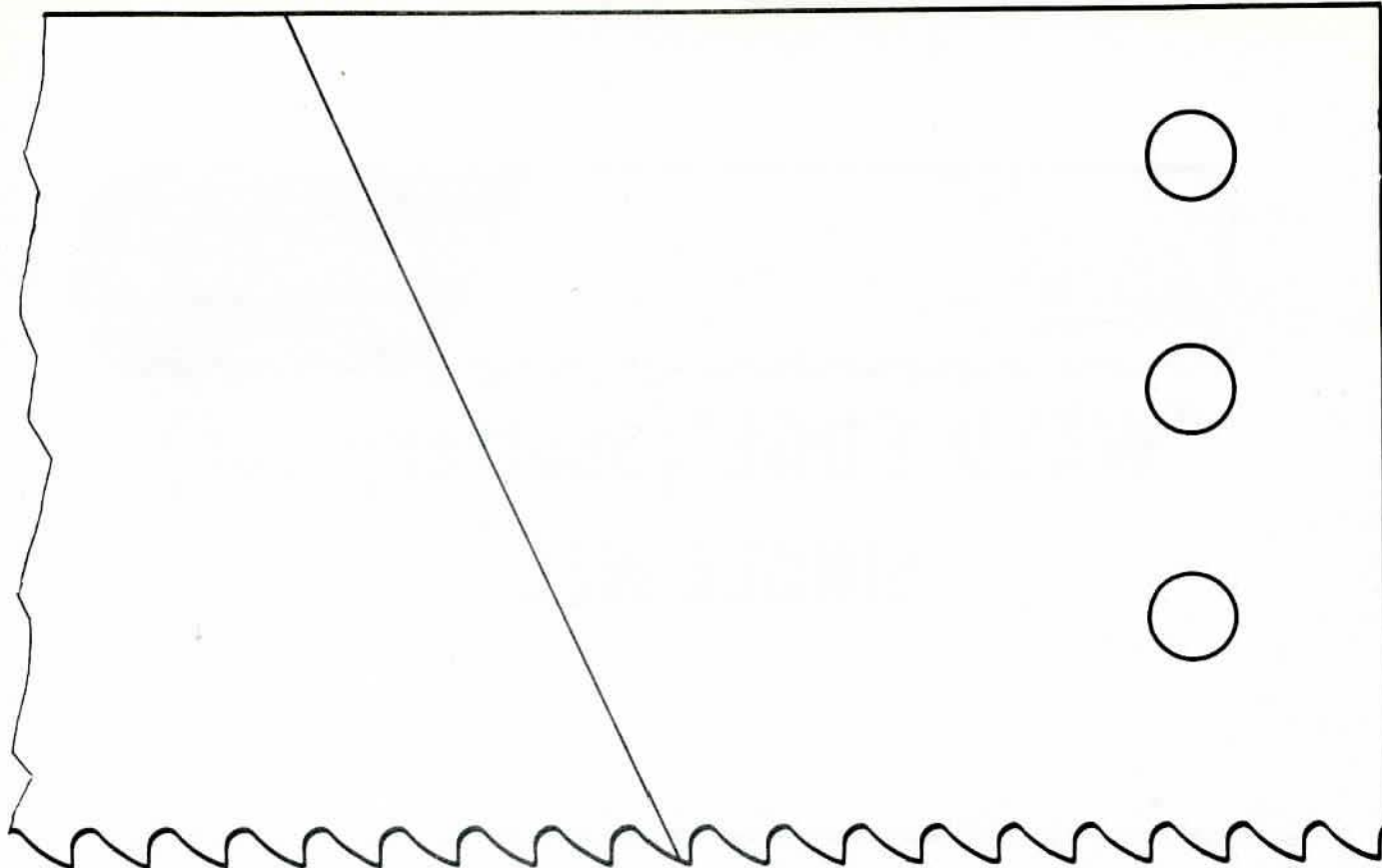


←Weld
too close
to pinhole

THREE METAL WELD



HARD EDGE



2½ teeth to inch



4 teeth to inch



6 teeth to inch



10 teeth to inch



14 teeth to inch

Illustration No. 12

a large chip, it is necessary to have the increased gullet capacity afforded by the 2-1/2 tooth blade.

Three tooth blades. For the cutting of high alloys, titanium, molybdenum, etc., a three tooth blade often works to very good advantage. This tooth shape differs from the conventional style in that it is shorter with a large flat gullet and is furnished in every-tooth-set only. As we recommend Tungsten High Speed blades for high alloys, this blade is furnished only in Tungsten High Speed.

Four tooth blades. With the increased popularity of production machines where large work can be cut satisfactorily, the four tooth blade is fast becoming the most popular tooth size. The large gullet capacity of this blade makes it adaptable for a wide range of work. Unless the material to be cut is hard or abrasive, a four tooth blade can be used on stock from six inches up to eighteen inches in cross section. In such cases it will cut faster and necessitate less feeding pressure than a finer tooth saw.

Six tooth blades. Where the stock to be cut causes excessive wear and does not produce large chips, the six tooth blade should be used. The extra number of cutting points per inch will assure longer life on this type of material. Irregularly shaped pieces and stock six inches and smaller in cross section should be cut with this blade.

Ten tooth blades. Ten tooth blades are not furnished in the larger sizes as their use is restricted to hard materials and stock of small

cross section. It is a good tooth size for general cutting in the small machine shop where a variety of materials are cut, and where light machines applying only light down feed are used. (See Illus. 13)

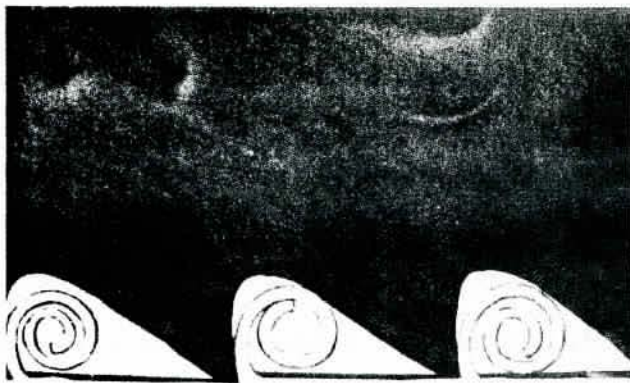
Fourteen tooth blades. When light tubing and angle iron are to be cut, a fourteen tooth blade should be used. Very hard stock of small size can also be cut with this blade. As the use of a fourteen tooth blade is restricted to small work, only a few of the smaller sized blades are furnished with this tooth spacing.

It must be remembered in selecting the proper tooth blade that the "three tooth" rule mentioned under Hand Blades also applies to Power Blades. When cutting pipe, angle iron or rail, the smallest cross section to be cut must be considered in selecting the correct tooth size. (See Illus. 14)

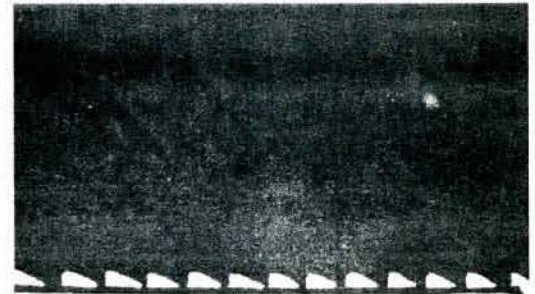
Choice of Blade Specifications for Job

It will be noticed in examining the list of blades regularly furnished that there may be two or three sizes having the same length but different thicknesses and widths. For heavy production it is advisable to use the heaviest size listed. The extra rigidity of the wider and thicker blade will produce straighter cuts, will permit a faster cutting rate and will give longer life.

Much consideration has been given the present list of Power Hacksaws to eliminate unneeded sizes and to add enough others to cover all cutting requirements. Thickness dimensions, starting with the .050 increase .012 - .013 for each larger width saw. The width of each saw is 20 times its thickness.

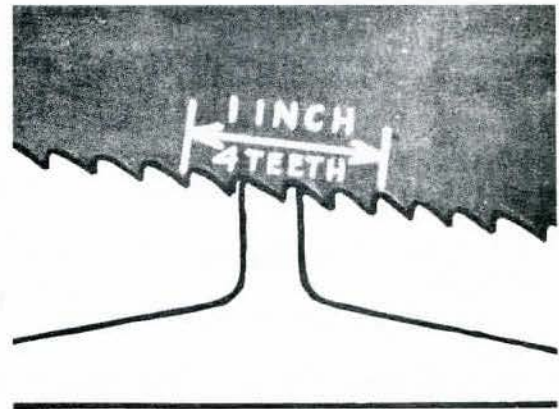
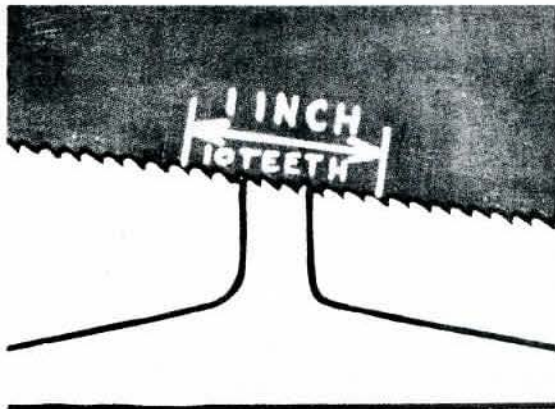


**Large Teeth Have Ample
Gullet Capacity for Cutting
Soft Materials**



**Small Teeth Clog
in Soft Material**

Illustration No. 13



Three Teeth Always Should be in Contact with the Work

Illustration No. 14

Page no. 15 was not scanned

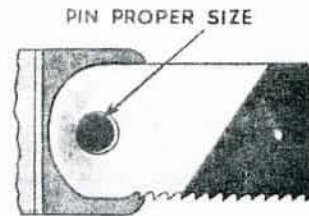
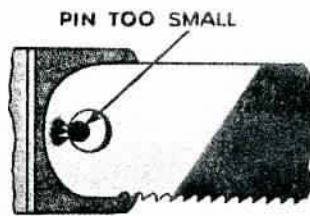
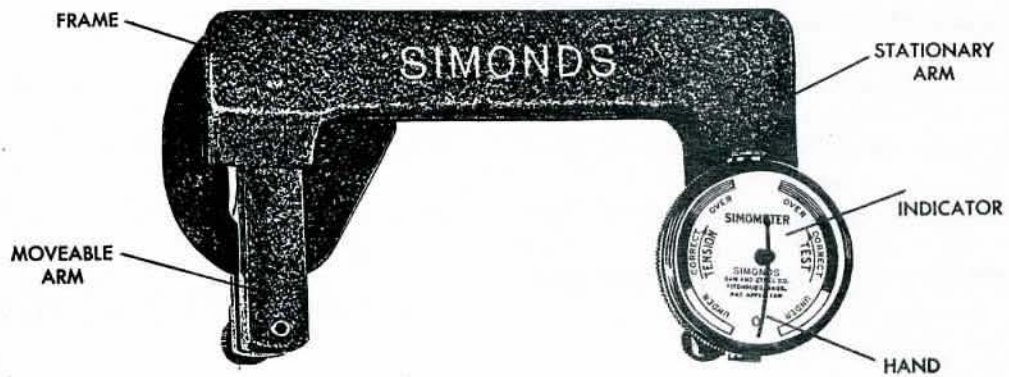


Illustration No. 15

THE SIMOMETER — Front View



THE SIMOMETER — Rear View

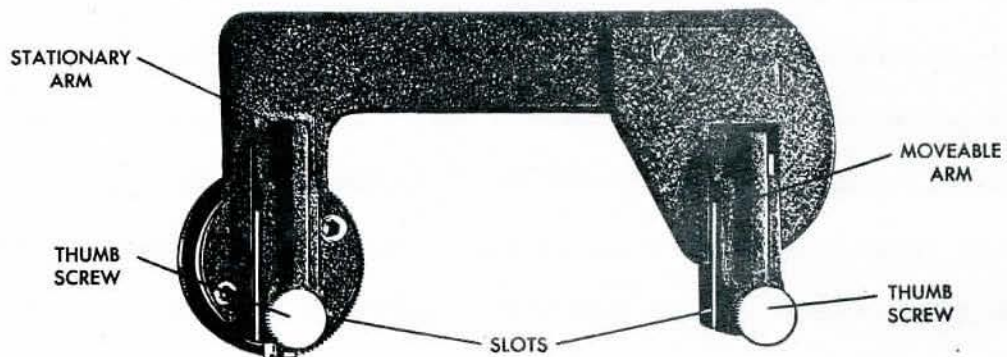


Illustration No. 16

Clamping Stock to be Cut

Single pieces of round and square stock are no problem to clamp in the vise of the machine. However, when many pieces of stock or irregular shaped materials are cut, care must be taken to hold all pieces firmly in place. One loose piece can put severe strain on the blade and may cause breakage.

Automatic bar feed machines are designed to go through the cutting cycle automatically moving the stock ahead and reclamping. It is very important to see that the reclamping device is working properly on this type of machine. A large number of small round bars can be cut in a V shaped fixture if clamped from the open side of the V. A double V block can be used to hold 2 round bars solidly. Illus. 17 shows several methods of holding stock so that it will not move in the vise of the machine. It is best, as in Hand Blades, to start the cut on the largest section of irregular shaped pieces.

(See Illus. 18)

Coolant

The use of a coolant is essential in power hacksawing. Coolant has two functions: one, to keep the blade cool during the cutting cycle; the other to remove chips from the cut. Any good grade of soluble oil mixed 20 parts of water to one of oil is adequate for most jobs. However, where High Alloy Steel is cut, high temperatures develop and a sulphur base oil will dissipate this heat more readily. Whichever type of coolant is used, an ample flow must be kept on the blade at all times. An exception to the general rule of using a coolant is

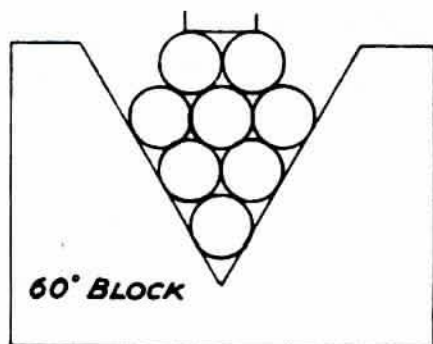
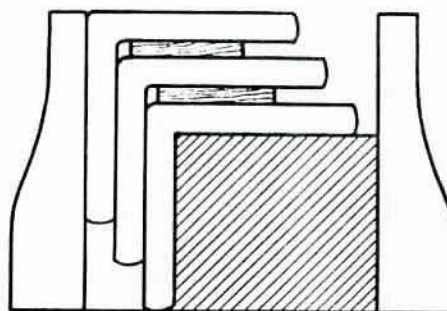
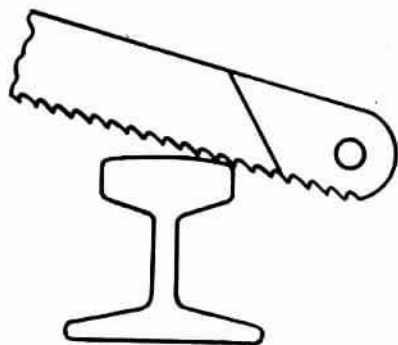


Illustration No. 17

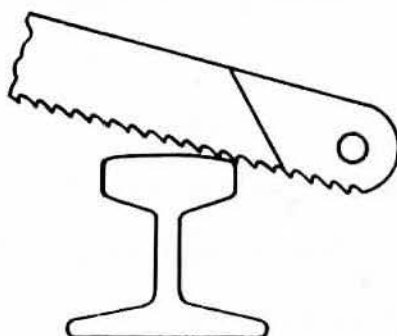


Illustration No. 18

cast iron. As cast iron produces no chips, but small particles of iron, no coolant is needed. Coolant in this case serves only to make the chips stick in the cut.

Types of Power Hacksaw

There are four popular types of Power Machines on the market today. Two have mechanical feed controls. The other two are controlled by hydraulic methods. Where the controls can be found are shown in Illus. 19a, b, c and d. There are other machines still in use that have gravity, spring, or other types of mechanical feeds which are not shown, as they are fast being superceded by the above mentioned modern machines.

Machine Adjustments

Feed

It is difficult to give definite rules as to the feeding pressure to use on different types of materials as no two machine manufacturers use the same method for adjusting the down feed of their machine. As a generalization, a machine should not feed more than .012" per stroke cutting soft materials such as aluminum, cold rolled steel, etc. As the material to be cut becomes higher in alloy or harder, these feeds must be materially reduced to the point where only .002" - .003" per stroke may be the down feed on such materials. This system is not too practical because it is not always easy to measure exact down feed. Most machine manufacturers have a chart giving recommended feeds and speeds fastened to each machine. These can only serve as a generalization, as machines of the same identical manufacture may not have the

Illustration No. 19 a

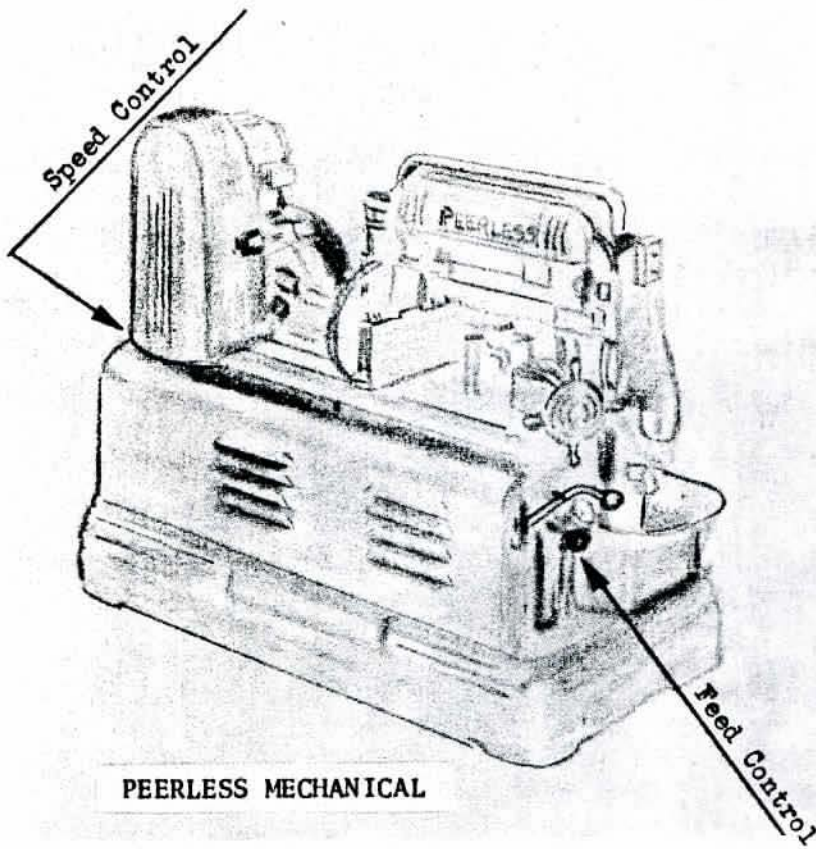
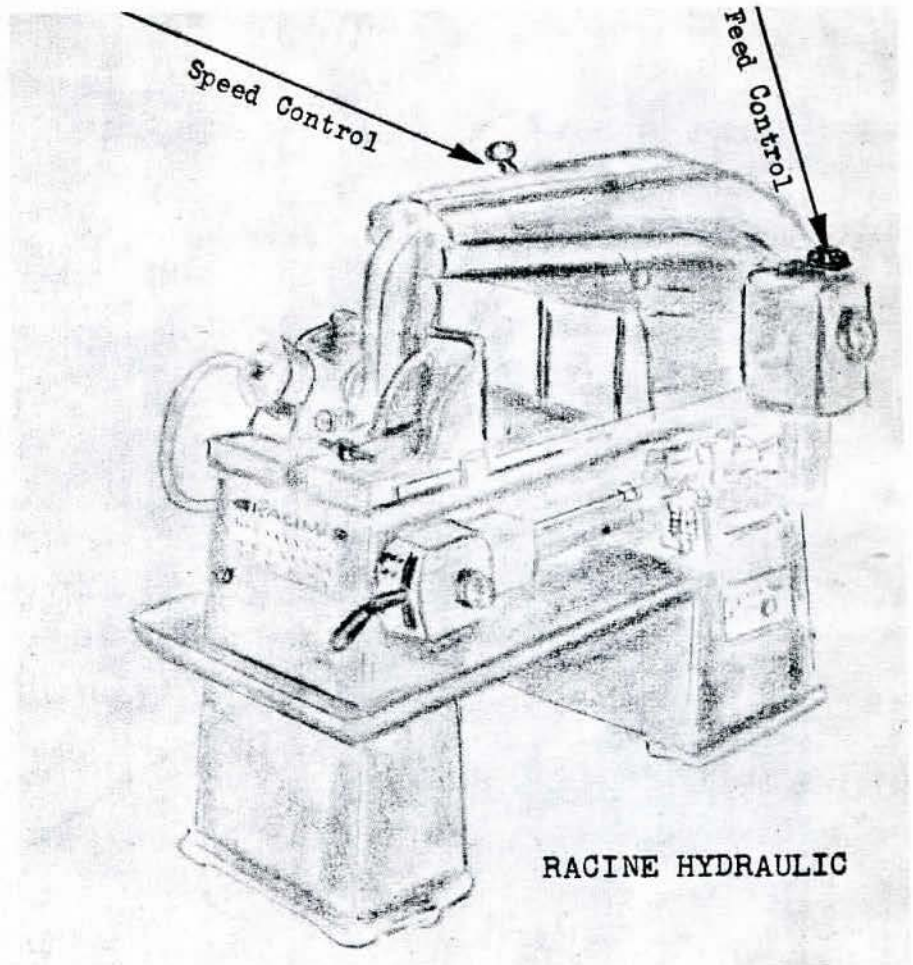


Illustration No. 19 b



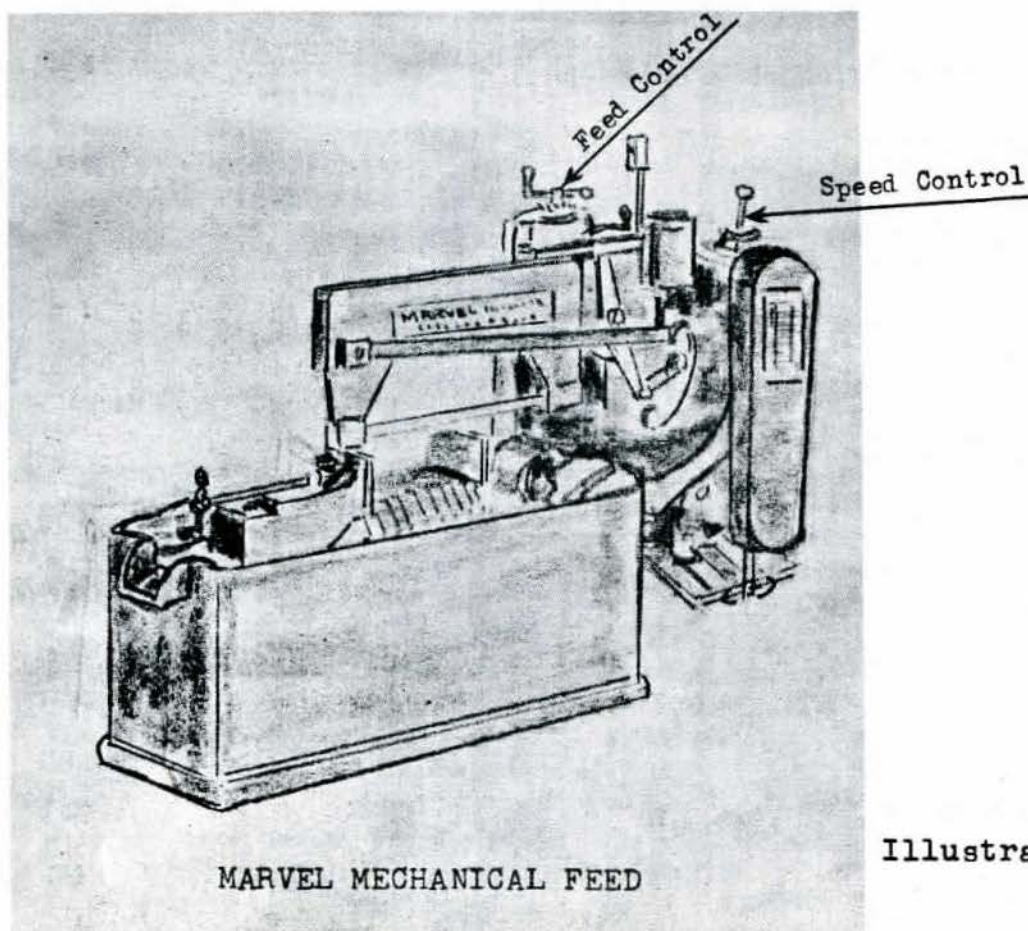
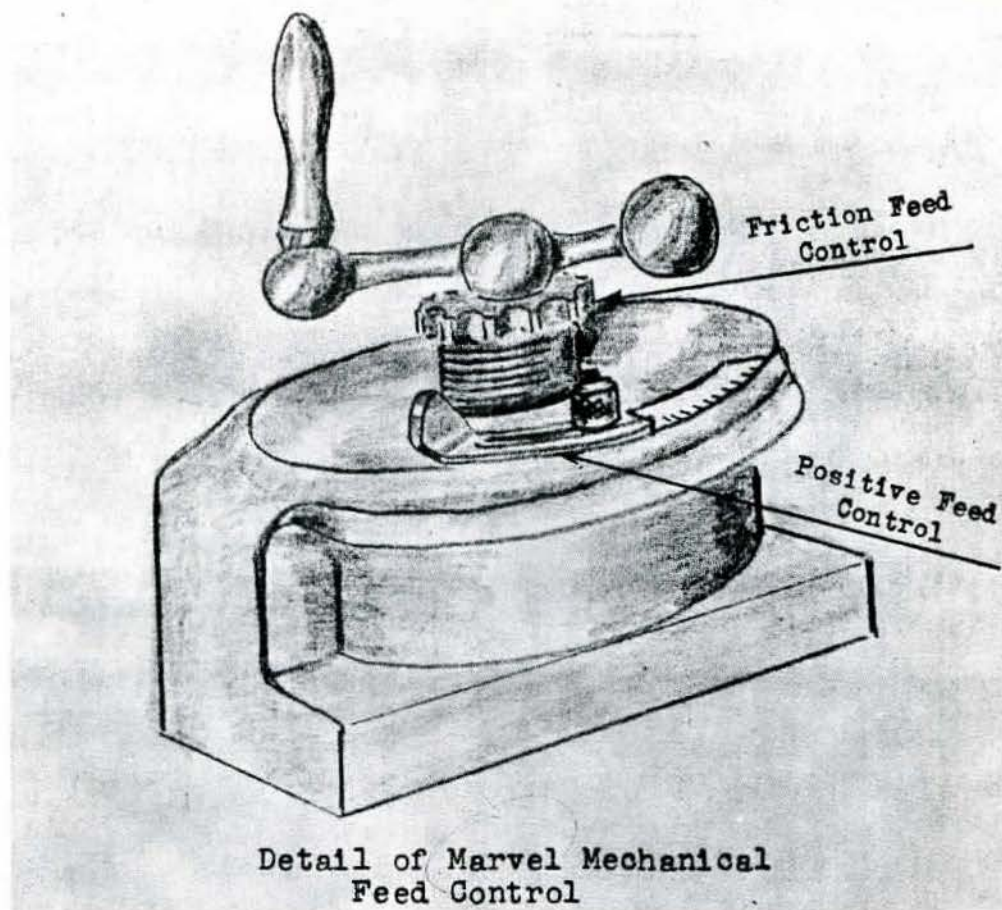
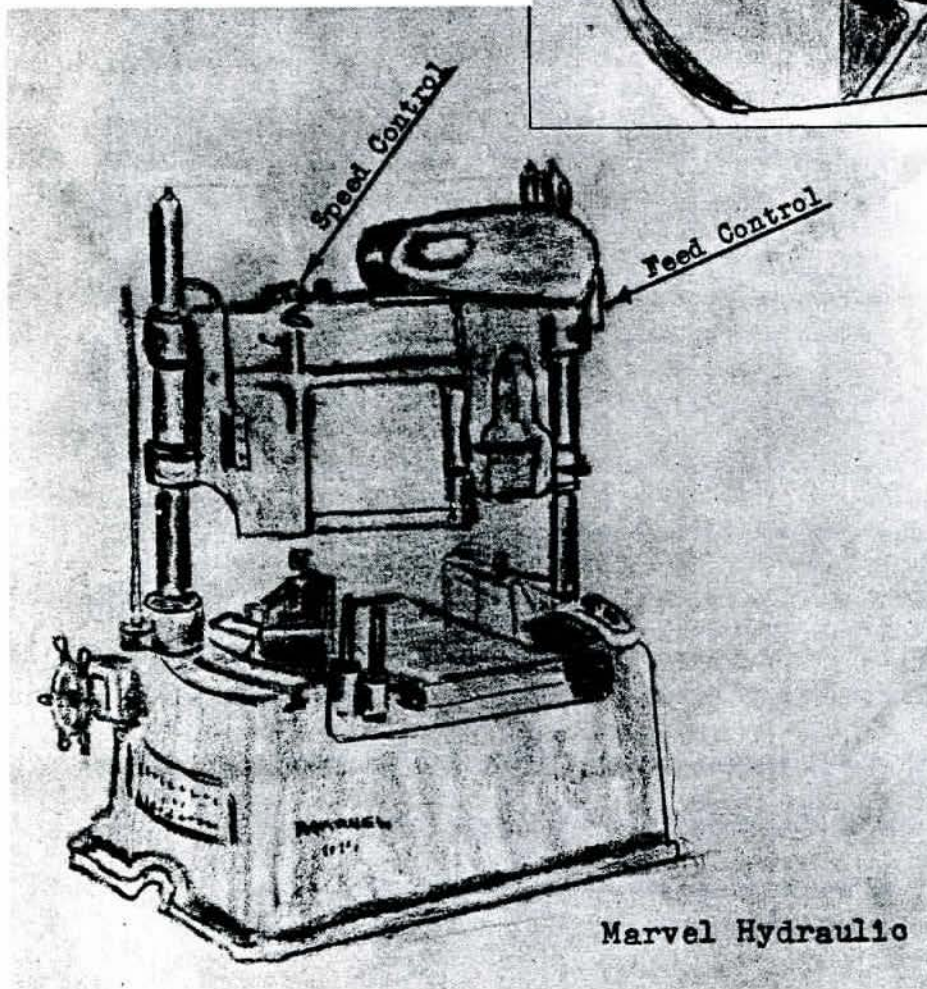
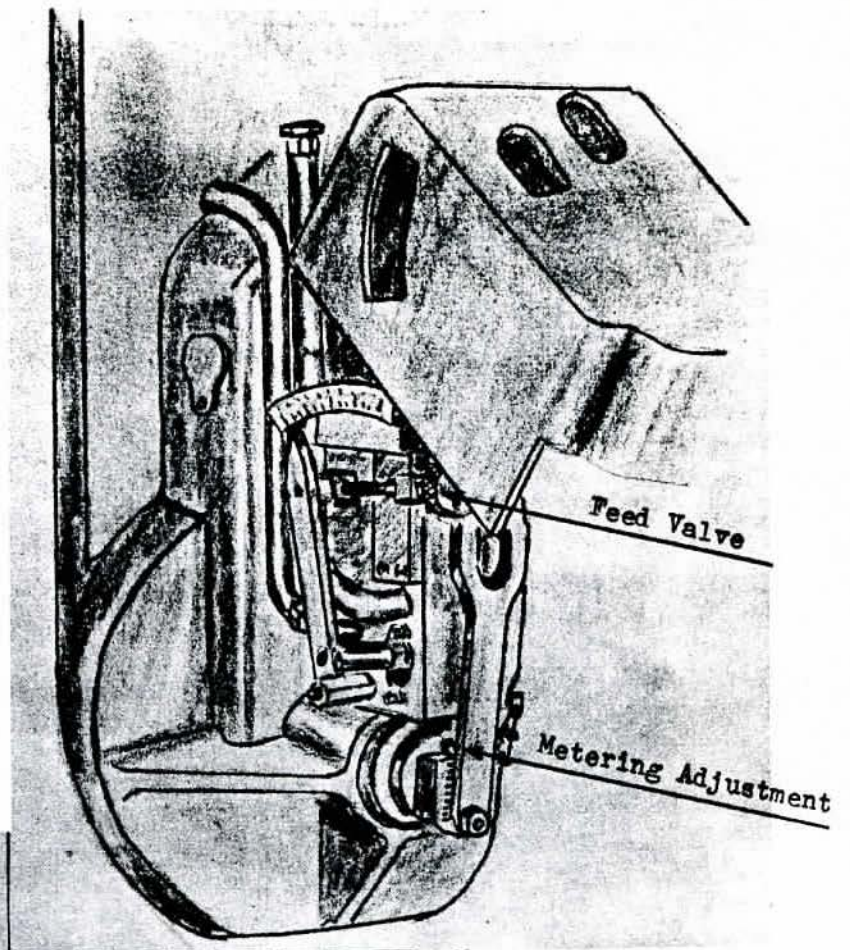


Illustration No. 19 c

Detail of
Feed Control



Marvel Hydraulic

same feeding characteristics. In short, a few simple observations and rules can best serve in the selection of a proper feed.

1. Always start the cut carefully, being sure that the blade does not take too heavy a chip. When starting a cut with a new blade, the feed should actually be reduced. This is a very important point, as a new blade can be ruined on the first few strokes if this is not done. New hacksaw blades are very sharp and if heavy feeds are used, small, almost microscopic chips break off the sharp cutting edge of the teeth. This chipping, if allowed to occur, will greatly shorten the life of the blade.
2. As the blade cuts into the bar, the feed can be increased slowly until a good chip is rolled out the front end of the cut. When adjusting the down feed, it is helpful to make a study of the chips being formed. Different materials, of course, change the formation of the chips, but well formed chips should be falling from the cut on each stroke of the machine. If a straw or blue color is seen in these chips, more coolant must be put in the cut or the feed reduced.
3. On each cutting stroke, a hacksaw bows or flexes so that the back edge is convex. (See Illus. 20) When adjusting feed, notice how much the blade flexes. If the feed is excessive the blade may bow more than the lift of the machine on the return stroke. This

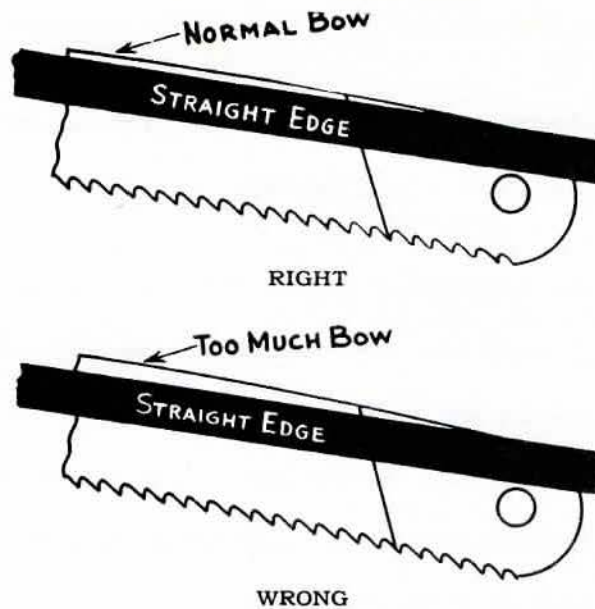


Illustration No. 20

POWER HACKSAW SPEED CHART

Recommendations are only approximate and may vary with the structure and hardness of stock.

MATERIAL

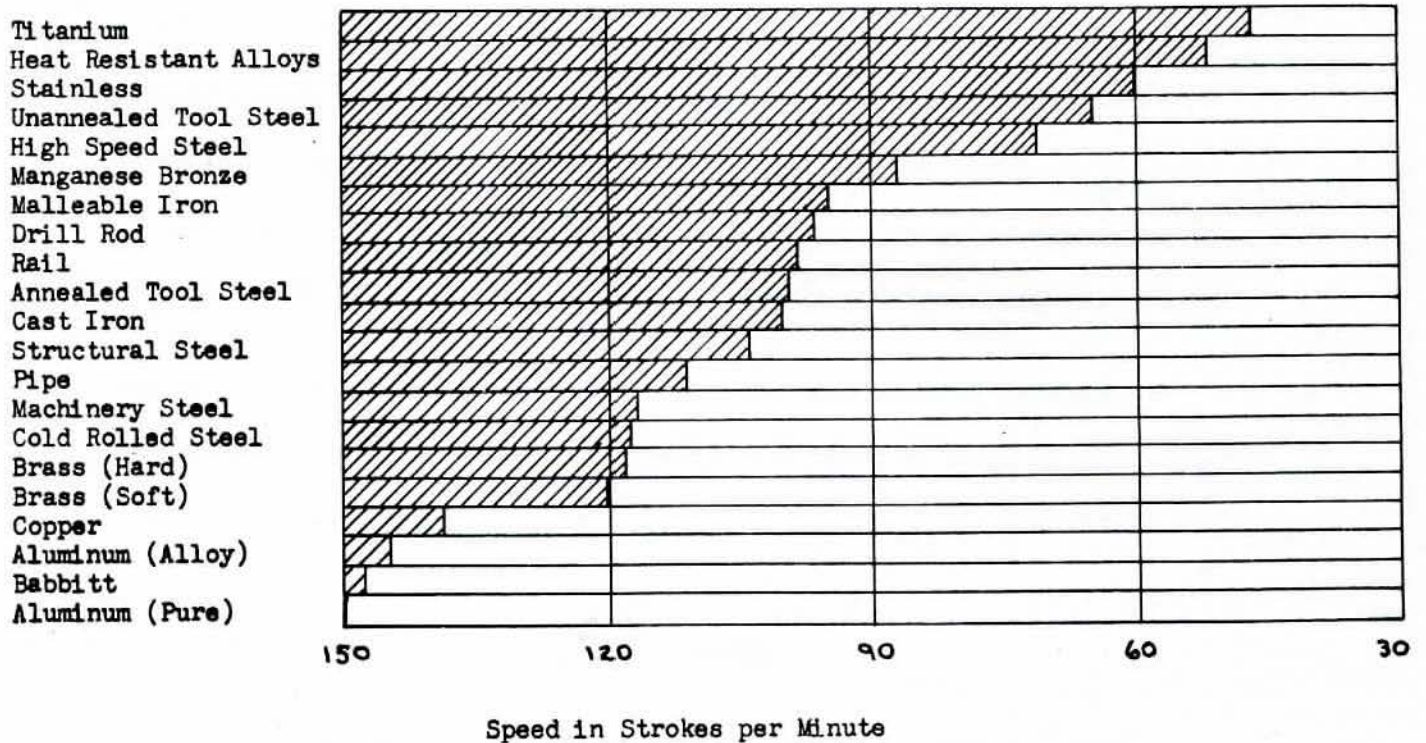


Illustration No. 21

allows the blade to rub in the cut and will cause premature blade failure.

4. The appearance of the finished cut gives an indication of how the machine is feeding. If the cut curves out in the middle, the feed is too heavy. Also, if the surface of the cut is not smooth, but has a rough surface with small particles of chips sticking to it, down feed is excessive.
5. Listening to the blade cut also gives an indication of how effectively the saw is cutting. If the machine growls or appears overloaded, the chances are that the feed is too heavy. The blade itself should make a "swishing" noise on the cutting stroke and little noise should be heard on the return stroke.

Titanium, Stainless, and High Alloy heat resistant steels used in aircraft engines, require extra heavy down feeds. On these materials, if teeth rub over the work because of insufficient feed, the surface to be cut work hardens and becomes almost impossible to cut.

Remember, a Power Hacksaw Blade dulls faster by rubbing over the work than it does by cutting. Always feed with enough pressure to keep all teeth cutting.

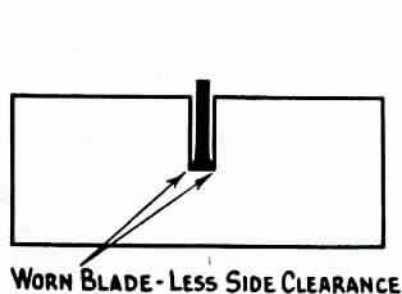
Speed Selection

Normal operating speeds for Power Hacksaw Blades vary from 60 to 165 strokes per minute. Strokes can be increased to the top limits of the

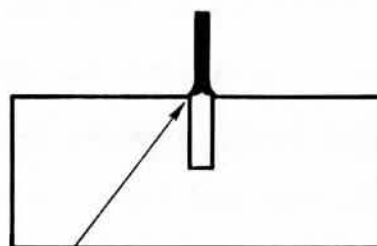
machine in cutting soft and low alloy steels. On harder materials, and as alloying elements increase, lower speeds must be used. There is a general tendency on the part of machine manufacturers to recommend higher speeds than are consistent with good blade life. It is our belief that slow speeds with moderately heavy feeds result in the best economy. There are several reasons to substantiate this belief.

1. Slower speeds allow the blade to do less rubbing and more cutting.
2. Faster speeds shorten machine life.
3. Faster speeds tend to amplify sloppy conditions found on worn machines. Under these conditions, blades are more apt to cut crooked.
4. High cutting speeds generate high temperatures on the tip of hacksaw teeth. This may result in chins welding onto the teeth causing the tips to break off.

The accompanying table (Illus. 21) shows approximate speed settings for different type materials. It must be remembered that various factors other than the chemical analysis contribute to the machinability (or in this case, ease of sawing) of the stock. Hardness, of course, is a large factor. Structure, and even the method used in melting the material, may greatly affect its machinability. For example, two steels of the same analysis and hardness, but different in structure, may vary as much as 50% in machinability. Hacksaw Blades are materially affected by these variables, so that any chart of machine speeds must be used with particular care.



WORN BLADE - LESS SIDE CLEARANCE

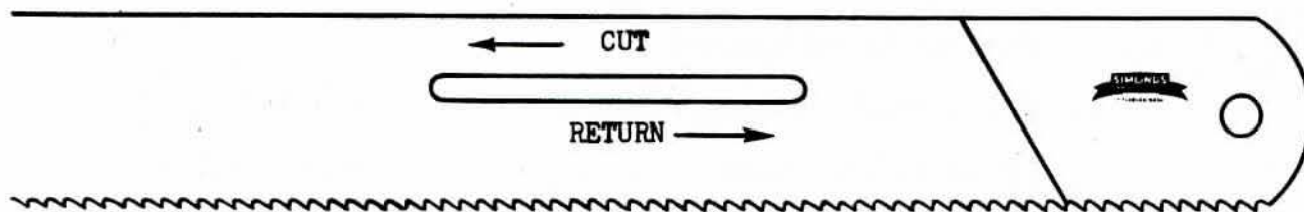


NEW BLADE - SET IS WIDER THAN OLD CUT

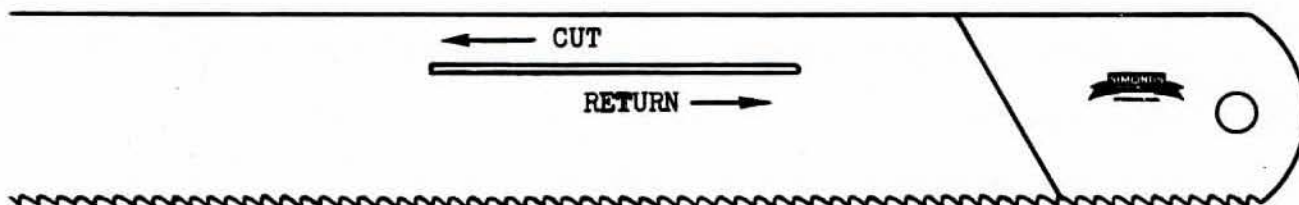
Illustration No. 22

BLADE "LIFT" ANALYSIS

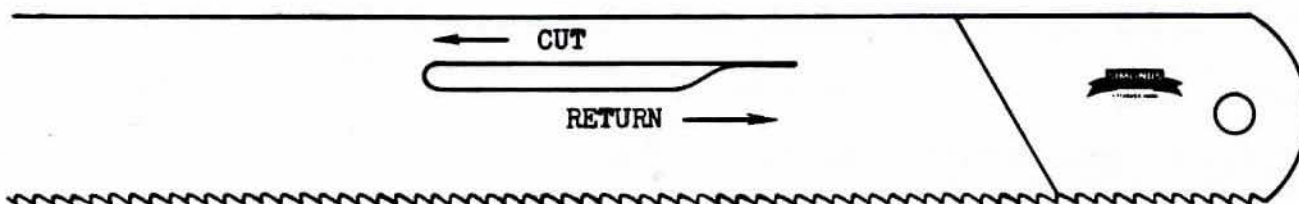
Made by placing pencil point on Power Blade while cutting.



Satisfactory Blade Lift on Return Stroke



Insufficient Lift on Return Stroke - (Causes Excessive Wear)



Blade Feeding Down Before Return Stroke Completed
(A Condition Very Injurious to Blade Life)

Illustration No. 23

Replacing Worn Blades

It is poor economy to cut with dull blades. Cutting time is greatly increased and valuable stock may be wasted. Worn or dull blades usually fail by cutting off square. If the old blade is replaced by a new one before the cut is completed, a new blade should not be put in the old cut. The old blade has lost some of its clearance and is cutting a narrower slot. Putting a new blade in this slot causes heavy strain on the outer corners of the teeth and may cause tooth breakage. Always turn the bar over and start cutting so that the new cut will meet the old one. (See Illus. 22) .

Machine Repair

Often power hacksaw machines are allowed to become worn to such an extent that blade life is materially shortened.

The ways on which the saw frame slides may become worn to such an extent that it is impossible to make straight cuts. If this condition exists, it can easily be detected by firmly grasping the blade in the frame and trying to move the blade sidewise. If excessive sloppiness is discovered, the condition should be remedied.

Often machines out of adjustment do not lift the blade on the return stroke. This condition is especially serious and should be corrected at once. A good method to use in checking lift is to hold a pencil solidly against the saw while it is cutting. The pencil should mark a flattened oval on the saw. If the mark on the blade appears as a straight line, the blade is not lifting on the return stroke. If the

mark on the blade has a sharp angle towards the red end of the saw, the saw is very probably dropping onto the work before it has completed its back stroke. This condition is also very injurious to blade life.

(See Illus. 23)

A constant feed should be maintained throughout the whole cutting cycle. Often this is not the case, as neglected machines may feed in a series of jerks. This means that at times the blade is rubbing on the stock to be cut and that at other times it is being fed too hard. Visual observation usually can discover this condition.

Common Faults and

How to Correct Them

Excessive Tooth Wear Caused by:

1. Too high speed--heat generated dulls points, or blades rub and do not cut because material is too hard to permit teeth to "bite".
2. Too heavy feed. Blade gullets fill with stock being cut, and slide over the work.
3. Blade not lifting on the back stroke. Check the machine for return lift.
4. Blades mounted to cut in wrong direction.
5. Insufficient or improper cooling solution. Use soluble oil and water mixed approximately twenty parts of water to one of oil.
6. Wrong tooth size for material being cut.
7. Starting new blade with too heavy feed. Sharp points chip off and teeth dull rapidly.

Replacing Worn Blades

It is poor economy to cut with dull blades. Cutting time is greatly increased and valuable stock may be wasted. Worn or dull blades usually fail by cutting off square. If the old blade is replaced by a new one before the cut is completed, a new blade should not be put in the old cut. The old blade has lost some of its clearance and is cutting a narrower slot. Putting a new blade in this slot causes heavy strain on the outer corners of the teeth and may cause tooth breakage. Always turn the bar over and start cutting so that the new cut will meet the old one. (See Illus. 22)

Machine Repair

Often power hacksaw machines are allowed to become worn to such an extent that blade life is materially shortened.

The ways on which the saw frame slides may become worn to such an extent that it is impossible to make straight cuts. If this condition exists, it can easily be detected by firmly grasping the blade in the frame and trying to move the blade sidewise. If excessive sloppiness is discovered, the condition should be remedied.

Often machines out of adjustment do not lift the blade on the return stroke. This condition is especially serious and should be corrected at once. A good method to use in checking lift is to hold a pencil solidly against the saw while it is cutting. The pencil should mark a flattened oval on the saw. If the mark on the blade appears as a straight line, the blade is not lifting on the return stroke. If the

mark on the blade has a sharp angle towards the red end of the saw, the saw is very probably dropping onto the work before it has completed its back stroke. This condition is also very injurious to blade life.

(See Illus. 23)

A constant feed should be maintained throughout the whole cutting cycle. Often this is not the case, as neglected machines may feed in a series of jerks. This means that at times the blade is rubbing on the stock to be cut and that at other times it is being fed too hard. Visual observation usually can discover this condition.

Common Faults and

How to Correct Them

Excessive Tooth Wear Caused by:

1. Too high speed--heat generated dulls points, or blades rub and do not cut because material is too hard to permit teeth to "bite".
2. Too heavy feed. Blade gullets fill with stock being cut, and slide over the work.
3. Blade not lifting on the back stroke. Check the machine for return lift.
4. Blades mounted to cut in wrong direction.
5. Insufficient or improper cooling solution. Use soluble oil and water mixed approximately twenty parts of water to one of oil.
6. Wrong tooth size for material being cut.
7. Starting new blade with too heavy feed. Sharp points chip off and teeth dull rapidly.

8. Starting new blade in cut partly completed with worn blade.

Crooked Cuts Caused by:

1. Tension too loose.
2. Set worn on one side--replace blade.
3. Machine slides worn or out of adjustment. Make necessary repairs.
4. Too heavy feed.
5. Hard spots in stock being cut--blade takes path of least resistance.
6. Imperfect seating of blade ends between holders.
Presence of dirt or chips, also set of blade coming within holder faces may cause this condition.

Excessive Breakage Caused by:

1. Using worn blade.
2. Too heavy feed.
3. Too coarse a tooth for walls of material being cut.
4. Teeth too fine, gullets clog and broken teeth result.
Overloaded gullets will often cause blade itself to break.
5. Stock loosening in vise.
6. Dropping blade on stock. Start feed just over material to be cut.
7. Tension of blade too tight or too loose.
8. Starting new blade in cut partly completed with worn blade.

Breaking Out of Pin Holes Caused by:

1. Too much tension.
2. Pins too small or grooved from wear.
3. Improper seating between holders.

Stripping of Teeth Caused by:

1. Using tooth too coarse for walls of material being cut.
2. Teeth too fine, fill with stock being cut, overloading gullets.
3. Starting on sharp corners or thin sections.

HACKSAW SPECIFICATION CHART

Length	Width	Thickness	Length Overall	Length Center to Center of Pinholes	Pinhole Diameter
10"	1/2"	.025	10-3/8	9-7/8	5/32
12"	1/2"	.025	12-3/8	11-7/8	5/32
12"	5/8"	.032	12-1/2	11-7/8	3/16
12"	1"	.050	12-3/4	11-7/8	9/32
14"	1"	.050	14-3/8	13-1/2	9/32
14"	1-1/4"	.062	14-1/2	13-1/2	9/32
14"	1-1/2"	.075	14-1/2	13-1/2	9/32
17"	1"	.050	17-3/8	16-1/2	9/32
17"	1-1/4"	.062	17-1/2	16-1/2	9/32
18"	1-1/4"	.062	18-1/2	17-1/2	9/32
18"	1-1/2"	.075	18-1/2	17-1/2	9/32
18"	1-3/4"	.088	18-3/4	17-1/2	9/32
21"	1-3/4"	.088	22-1/4	21	9/32
24"	1-3/4"	.088	25-1/4	24	9/32
24"	2	.100	25-1/4	24	25/64
30"	2-1/2"	.100	32	30	25/64
36"	4-1/2"	.125	38	36	1/2*

* This blade has 3 pinholes at each end.

SIMONDS "WELD-EDGE" HOLE SAWS

The complete line of Hole Saws now available is the result of several years work by our factory engineers. In every respect the saw is of the highest quality with the superior cutting and shatterproof characteristics of our "Weld-Edge" Hacksaw Blades.

The Hole Saw is becoming increasingly popular as an efficient means of cutting holes in any materials that can be machined. It is especially well suited for cutting large holes in relatively thin stock where the conventional drill is apt to bind.

Hole Saw sizes range from 9/16" to 6" in diameter and will cut up to 1-1/8" in depth. It is this wide size range and their moderate cost that make them the choice of tool engineers for many jobs where drilling, boring or turning were previously done. They are very fast cutting because only a small amount of stock is machined away to make a relatively large hole.

Hole Saws can be considered in three different parts: the saw itself, the arbor and the drill or pilot pin. Our line includes 55 different sizes of Hole Saws--all made from the same steels used in our "Weld-Edge" Hacksaw Blades. In fact, all the tothing, setting and hardening operations are identical to those of our regular High Speed "Weld-Edge" Power Blades, therefore these saws can be expected to give many hours of trouble-free cutting on the most difficult job.

All Hole Saws are made with 6 teeth to the inch. Slots on the sides of the saw are provided for removing cores. The saw blank, after forming to the desired diameter, is spot welded to an accurately machined cup. In

the center of each cup there is a tapped hole. For the smaller saws, this hole is 1/2" x 20 thread and on the larger saws, 5/8" x 18 thread (see catalog section for details).

The Hole Saw is driven by an arbor or mandrel which is screwed into the centrally located tapped hole. Saws 1-1/4" and larger have two additional drive holes which, when assembled with the pin-drive arbors, prevent the saw from becoming too tight on the arbor and give a self-aligning feature to the tooth edge when the saw is used.

The second part of the Hole Saw combination is the arbor or mandrel. The arbor provides the connection between the Hole Saw and the power tool which rotates it. We furnish 7 different arbors (see catalog listing) which gives us the largest assortment in the industry. These are all carefully machined for accuracy and heat treated for greater strength and longer life. All arbors, except the largest one, have hexagonal shanks for insertion into the jaws of the power tool. This makes for a positive non-slip drive. The largest arbor (No. 36-01040) has a #3 Morse Taper Shank and the saw is fastened to it by either two or three screws depending upon saw diameter. Each arbor is made for a specific job and the catalog section should be referred to when making recommendations.

The third part of the Hole Saw assembly is the pilot drill or pilot pin. Drills and pilot pins serve to guide and stabilize the Hole Saw as it cuts. Two types of High Speed Steel drills are furnished: (1) the Short Flute type is used only in the two smallest arbors. (2) the regular High Speed Steel drill is used on all other arbors except the largest where a pilot pin is used. Pilot pins are recommended in applications where the speed of the hole saw is not compatible with the speed of the

drill to achieve maximum efficiency. This is particularly true in the cutting of thicker alloy steels where it is more efficient to drill a pilot hole first with necessary drilling speed, and then use the Hole Saw with a pilot pin operating at recommended Hole Saw speed.

Sometimes it is desirable to use a Morse Taper Drive rather than the conventional hexagonal shank. Taper Adaptors are available for this application, converting the 7/16" hexagonal shank to #2 or #3 Morse Taper Shank and the 5/8" hexagonal shank to a #3 Morse Taper Shank. For drilling deeper holes than the ordinary length arbors will allow, a 12" Arbor Extension can be furnished.

USE OF THE HOLE SAW

If the three basic parts of the Hole Saw are assembled correctly and a few simple rules concerning their use is observed, the maximum cutting efficiency can be attained.

The selection of the proper speed in running the saw is of the utmost importance. Tremendous heat can develop during the cutting operation which can produce welding of chips to the side of the teeth and cause ultimate failure of the saw blade. The speed chart furnished in each Hole Saw box should be followed very carefully.

Although it is possible to cut dry, we strongly urge the use of a liberal amount of cutting oil which will minimize welding, allow the saw to cut cooler and increase saw life. No lubricant, of course, should be used on cast iron.

Faster and more economical cutting results if the saw is cleared of the work frequently to remove chips from the bottom of the cut. The drill

should be set in the arbor so that it protrudes only slightly beyond the tooth edges of the saw. Breakage will result if the drill is set too far ahead of the saw blade. When using pilot pins, however, they should protrude 1/4" or more beyond the tooth edge, to fit into pre-drilled 1/4" or 3/8" holes and serve as a guide.

WHERE ARE HOLE SAWS USED?

Hole Saws are an economical means of extending the utility of portable electric drills, drill presses and lathes and their economy is acknowledged in many fields. A few of the potential users are listed below:

- Automotive industry
- Ship builders and boat yards
- Steel fabricators
- Paper Mills, Chemical Plants and other industries
where large amounts of piping or tubing are
used
- Aircraft manufacturers
- Auto mechanics
- Truck body and trailer manufacturers
- Electrical contractors
- Plumbing and Heating contractors
- Air conditioning and Ventilation engineers
- Sheet metal fabricators
- Commercial or home builders
- General machine shops
- Tool and die shops

ADVANTAGES OF SIMONDS HOLE SAWS

1. Top quality line with all cutting edges made of full High Speed Steel. Some competitors offer a lower alloy steel and designate it as a high speed saw.
2. Proven performance of our "Weld-Edge" hacksaw analysis.
3. Factory-controlled welding of High Speed Steel edge to Chrome Vanadium Steel body.
4. Salt bath heat treatment insures complete protection during hardening cycle.
5. Competitors 1/4" arbors consist of a saw holder held to the drill shank by a set screw. Our 1/4" arbor has a hexagonal shank which is an integral part of the arbor, therefore providing a more positive drive in drill chucks.
6. The drive pins on some competitive pin type arbors are threaded, consequently to replace a saw on an arbor it is necessary to remove the arbor from the chuck. With our design arbor, removal is not necessary to replace saw.
7. With one exception, competitors use a round hole and a set screw to drive the hexagonal arbor shank when placed in their Morse Taper adaptors. This method is not accurate and not a reliable drive. Our slotted, collet type Morse Taper adaptor is formed with a hexagonal hole for accurate alignment and positive drive.

